An Announcement of
Highway Safety Literature
. . . A Bi-Monthly Abstract Journal

HSL No. 72-15 August 4, 1972 HS-011 281 - 339; HS-800 658; 663; 665; HS-810 199; 201; 203; 212 - 213; HS-820 190; 193

HSL No. 72-15
August 4, 1972

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THIS ISSUE CONTAINS:

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HS-800 658; 663; 665
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U.S. Department of Transportation / National Highway Traffic Safety Administration

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An Announcement of
HIGHWAY SAFETY LITERATURE
. . . A Bi-Monthly Abstract Journal

Published twice-a-month by the National Highway Traffic Safety Administration,
Research Institute, Office of Accident Investigation and Data Analysis
Washington, D.C. 20590

INTRODUCTION

Publications such as journal articles, proceedings, and research reports announced in *Highway Safety Literature* include some of the most recent additions to the collection of the NHTSA Scientific & Technical Information Service. Subject areas covered include all phases of highway, motor vehicle, and traffic safety, especially those encompassed by the National Traffic and Motor Vehicle Safety Act of 1966 and the Highway Safety Act of 1966.

Individual issues of *HSL* are numbered according to the year and the issue number within that year; thus, 72 designates the year and 1, 2, 3, etc. the individual issues. To aid the user in locating citations by the HS-number, the cover bears the inclusive entry number for each issue.

Entries in *HSL* are arranged according to the NHTSA Subject Category List shown in the Table of Contents. The list is a two-level arrangement consisting of five major subject fields subdivided into 59 subject groups. Documents related directly to the National Highway Traffic Safety Administration (NHTSA) are announced in a separate section headed NHTSA DOCUMENTS and are numbered in five distinct series: NHTSA Accident Investigation Reports (HS-600 000 series). NHTSA Compliance Test Reports (HS-610 000 series), NHTSA Contractors Reports (HS-800 000 series), NHTSA Staff Speeches, Papers, etc. (HS-810 000 series), and NHTSA Imprints (HS-820 000 series). For NHTSA DOCUMENTS in series HS-600 000 and HS-610 000, individual full case reports are available for inspection at the National Highway Traffic Safety Administration. HS-800 000 series and HS-820 000 series are available for, purchase from NTIS or GPO (see page ii). Although announced together in a separate section, these documents are also assigned specific subject categories for machine retrieval.

A document which contains a number of separate articles is announced as a complete volume in the subject category most applicable to it as a whole. Entries for the individual articles appear in their most specific subject category.

SAMPLE ENTRIES

Subject Category Array	
NHSB Accession no	HS-800 218 Fld. 5/21; 5/9
Title of document	AN INVESTIGATION OF USED CAR SAFETY STANDARDS--SAFETY INDEX: FINAL REPORT. VOL. 6 - APPENDICES G-L
Personal author(s)	by E. N. Wells; J. P. Fitzmaurice; C. E. Guilliams; S. R. Kalin; P. D. Williams
Corporate author	Operations Research, Inc.
Collation	
Publication date	1969 150p Contract FH-11-6921 Report no. ORI-TR-553-Vol-6; PB-190 523
Abstract	Appendices G-L to this study of used car safety standards include: indenture model diagrams for classes I-IV motor trucks; degradation, wear, and failure data for motor truck classes I-IV; and safety index tables for classes I-IV motor trucks. Search terms; Wear; Trucks; Failures; Used cars; Inspection standards

AVAILABILITY: NTIS

HS-004 497 Fld. 5/19

AUTO THEFT–THE PROBLEM AND THE CHALLENGE

by Thomas A. Williams, Sr.

Journal citation .... Published in *FBI Law Enforcement Bulletin* v37 n12 p15-7 (Dec 1968)

Gives figures on the extent of the auto theft problem and comments on anti-theft devices available now or in the planning stage.

Search terms: Theft; Theft protection; Stolen cars

(Note: If the date of a report or Journal article is not given, the small letters nd will appear)

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NOTE: Material published in Highway Safety Literature (HSL) is intended for the information and assistance of the motor vehicle and highway safety community. While brand names, equipment model names and identification, and companies may be mentioned from time to time, this data is included as an information service. Inclusion of this information in the HSL should not, under any circumstances, be construed as an endorsement or an approval of any particular product, course, or equipment by the U.S. Department of Transportation, National Highway Traffic Safety Administration.

Harry A. Feinberg
Managing Editor

AVAILABILITY OF DOCUMENTS AND INSTRUCTIONS FOR ORDERING

Articles and reports whose citations and abstracts appear in HSL are acquired from many sources, such as periodicals, journals, NHTSA Contractors' reports and NHTSA staff speeches, and other reports. Those reports other than NHTSA Contractors' reports and NHTSA generated reports and speeches (see introduction) are assigned a lower consecutive accession (HS-) number.

Department of Transportation personnel may borrow copies of publications announced in HSL from the NHTSA Technical Reference Division. Non-DOT Personnel, in the Washington, D.C. area, may borrow copies of publications for a 24-hour period only. Telephone (202) 426-2768. Government personnel in the Washington, D.C. area, use government ID phone 118-62768.

The names of the journals cited in HSL appear in *italic type* preceded by the words "Published in." The journal containing the article cited may be borrowed from most research and public libraries. Non-DOT personnel outside the Washington area should contact their company or agency libraries for assistance.

NHTSA Contractors' reports and other reports can usually be obtained as indicated under AVAILABILITY. However, there is no certainty that copies will be available for more than a limited period after a report is issued.

The more common availability sources are identified by symbols which are explained in the next column:

NTIS: National Technical Information Service, Springfield, Va. 22151. Order by accession number: HS, AD, or PB. Prepayment is required by NTIS coupon, check or money order (made payable to NTIS). GPO coupons are not acceptable. Documents are available in paper copy (PC); in full size original or reduced facsimile, and on microfiche (MF) a 4x6" negative sheet of film (reader required).

GPO: Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Give corporate author, title, personal author, and report number. Prepayment is required by GPO coupon (NTIS coupons are not acceptable), check or money order (made payable to the Superintendent of Documents).

HRB: Highway Research Board, National Academy of Sciences, 2101 Constitution Ave., N. W., Washington, D. C. 20418.

NHTSA: National Highway Traffic Safety Administration, General Services Division, Washington, D.C. 20591 (Telephone (202) 426-0874), Give HS-No.

SAE: Society of Automotive Engineers, Dept. HSL, 2 Pennsylvania Plaza, New York, N.Y. 10001. Order by SAE report numbers. Prices given are list; discounts are available to SAE members and sometimes to libraries and U.S. Government Agencies. Prepayment is required; orders received without payment are subject to a $1 handling charge.

IMPORTANT NOTICE

WHEN REQUESTING a document, to be absolutely sure you receive what you order, give the accession number (HS, PB, AD number) or report number (in cases such as an SAE document), title of report, and the personal or corporate author (whichever is cited). When requesting an HS-numbered document from NTIS, add DOT/to the prefix HS-; example HS-800 000 should be ordered as DOT/HS-800 000.

1/0 ACCIDENTS

1/1 Emergency Services

HS-011 281 Fld. 1/1; 4/4

GOVERNMENT ROLE IN STATE AND COMMUNITY EMERGENCY RESPONSE SYSTEMS

by Dawson A. Mills

National Hwy. Traffic Safety Administration

Published in HS-011 284 *American Association for Automotive Medicine Proceedings of Fifteenth Conference*, New York, 1972, p388-92

Presented at the fifteenth conference of the American Assoc. for Automotive Medicine, Colorado Springs, 20-23 Oct 1971.

The state programs in emergency medical services are discussed in relation to the requirements of the Highway Safety Act of 1966. The quality of ambulance service needs improvement. Too much of the present emergency medical service facilities are fragmented and uncoordinated.

Search terms: Emergency medical services; Highway Safety Act of 1966; Ambulances; Federal role; Community support; State action

HS-011 282 Fld. 1/1

AREA WIDE EMERGENCY HEALTH SERVICE COUNCILS: THE GRASS ROOTS OF EMERGENCY CARE

by D. T. Freier; C. F. Frey

Michigan Univ.

Published in HS-011 284, *American Association for Automotive Medicine Proceedings of Fifteenth Conference*, New York, 1972, p393-97 4refs

Presented at the fifteenth conference of the American Assoc. for Automotive Medicine, Colorado Springs, 20-23 Oct 1971.

Emergency health care has been receiving increasing attention in recent years. There are eighteen national organizations at least whose objectives include the improvement of emergency care, and coordination of their efforts is needed. Coordination of emergency care at the local level is also needed to eliminate waste and achieve efficiency.

Search terms: Emergency medical services; Community support; Local government; Regional planning

HS-011 283 Fld. 1/1

A SURVEY OF EMERGENCY MEDICAL SERVICES IN THE DETROIT METROPOLITAN AREA

by Ronald L. Krome; Robert F. Wilson; Spencer Schron

Wayne State Univ.; Greater Detroit Area Hospital Council

Published in HS-011 284, *American Association for Automotive Medicine Proceedings of Fifteenth Conference*, New York, 1972, p398-409

Presented at the fifteenth conference of the American Assoc. for Automotive Medicine, Colorado Springs, 20-23 Oct 1971.

On-site investigations and a questionnaire were used to evaluate the following parameters: organization of emergency departments; physical facilities; available equipment; emergency department staffing patterns; hospital admission policies; back-up staff for the emergency department; availability of special care units, operating rooms, laboratories, blood bank facilities, and X ray units.

Search terms: Emergency medical services; Surveys; Detroit; Hospitals; Hospital emergency rooms; Manpower utilization; Questionnaires

1/2 Injuries

HS-011 284 Fld. 1/2; 3/11; 1/3

AMERICAN ASSOCIATION FOR AUTOMOTIVE MEDICINE PROCEEDINGS OF FIFTEENTH CONFERENCE

American Assoc. for Automotive Medicine

1972 414p refs

Includes HS-011 281, 282, 283, 285 - 290, 292 - 298, 304, 306 - 312, 327, 328, 336

Papers presented at the conference cover the following subjects: highway accident analysis; injury mechanisms; restraint system effectiveness and usage; crashworthiness; pedestrian accidents; injuries of specific areas of the body; multidisciplinary accident investigations; bridge abutments; racing and safety; defect recall campaigns; carbon monoxide, smoking, and fatal crashes; alcohol and highway safety; whiplash injuries; vision and driving; advanced driver education; cardiac patients and driving; and emergency medical services.

Search terms: Accident studies; Accident analysis; Injury causes; Automobile interior design; Restraint system effectiveness; Restraint system usage; Crashworthiness; Pedestrian accidents; Cervical spine injuries; Collapse; Chest injuries; Leg injuries; Head injuries; Child injuries; Multidisciplinary teams; Abutments; Racing; Accident survivability; Recall campaigns; Carbon monoxide; Smoking; Alcohol breath tests; Alcohol Safety

1/2 Injuries (Cont'd.)

HS-011 284 (Cont'd.)

Action Projects; Whiplash injuries; Vision; Driver education; Heart diseases; Emergency medical services; Canada; Detroit; Community support

AVAILABILITY:
Corporate author
801 Green Bay Road
Lake Bluff, Ill. 60044 $10.00

HS-011 285 Fld. 1/2

SOME INJURY MECHANISMS IN NEW CAR COLLISIONS

by Donald F. Huelke; Harold W. Sherman

Michigan Univ.

Published in HS-011 284, *American Association for Automotive Medicine Proceedings of Fifteenth Conference,* New York, 1972 p8-26

24refs

Presented at the fifteenth Conference of the American Assoc. for Automotive Medicine, Colorado Springs, 20-23 Oct 1971.

Because of the safety features of the newer model cars, occupant injuries are markedly reduced in extent and severity when old versus new model car crashes are compared. Occupant ejection via door openings is markedly reduced due to changes in the lock striker mechanism. The energy absorbing steering column, the instrument panel padding, the new thicker laminate windshield and other safety features are all contributing to the reduction in the number of fatal injuries and decreasing the severity of other injuries. For this study, automobile crashes involving cars of the present and past model year were investigated.

Search terms: Injury prevention; Ejection; Steering wheel caused injuries; Windshield caused injuries; Laminated glass; Instrument panel caused injuries; Restraint systems; Vehicle age; Injury severity

HS-011 286 Fld. 1/2

OBSCURE INJURY MECHANISMS IN AUTOMOBILE ACCIDENTS

by John D. States; James S. Williams; Martin W. Korn; David N. Kluge; John G. Balcerak

Rochester Univ.; Rochester Applied Science Associates, Inc.

Published in HS-011 284, *American Association for Automotive Medicine Proceedings of Fifteenth Conference,* New York, 1972 p47-57

22refs
Contract FH-11-6796; FH-11-7422

Presented at the annual meeting of the American Assoc. for the Surgery of Trauma, New York, 14 Oct 1971 and at the fifteenth Conference of the American Assoc. for Automotive Medicine, Colorado Springs, 20-23 Oct 1971.

Case studies describe injury mechanisms of not infrequently seen accident injuries. The frequency of such injuries is not determined, but the severity and long-term disability resulting from these injuries makes injury control a justifiable objective. Injuries described were mainly of the lower torso and lower extremities, with one case including an arm fracture.

Search terms: Injury causes; Injury case reports; Femoral neck fractures; Hip injuries; Knee injuries; Spinal fractures; Spinal cord injuries; Fractures; Foot injuries; Leg injuries; Arm injuries

HS-011 287 Fld. 1/2

MECHANISM OF CERVICAL SPINE INJURY IN AUTO ACCIDENTS

by Harold D. Portnoy; James H. McElhaney; John W. Melvin; Paul D. Croissant

Pontiac General Hosp.; Michigan Univ. Hwy. Safety Res. Inst.; Crittenton Hosp.

Published in HS-011 284, *American Association for Automotive Medicine Proceedings of Fifteenth Conference,* New York, 1972 p58-83

20refs

Presented at the fifteenth Conference of the American Assoc. for Automotive Medicine, Colorado Springs, 20-23 Oct 1971.

Medical data for 55 cervical spine injury victims of auto accidents seen over the last seven years were reviewed. Associated head injury was particularly noted. Twenty-nine patients had usually transient altered states of consciousness. Three mechanisms of injury were defined, each associated with a particular type of head injury. Injuries to the face produced extension-tension fractures. The most common fracture in this group was the "Hangman's" fracture. Injuries to the forehead and frontal regions produced extension-compression fractures. Posterior small parts fractures were usually seen. Injury to the parieto-occipital regions produced flexion-compression fractures. This mechanism resulted in wedge and burst fractures of the lower cervical vertebral bodies and anterior dislocations. The first two mechanisms seldom produced neurological deficit while the third frequently resulted in a transverse myelitis. Odontoid fractures are discussed separately. Careful examination of an accident victim's head should be carried out looking for clues indicative of an associated cervical spine injury.

Search terms: Cervical spine; Spinal fractures; Neck injuries; Facial injuries; Head injuries; Neurologic manifestations; Medical treatment; X rays; Injury causes

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HS-011 288 Fld. 1/2; 5/4

COMPARTMENT COLLAPSE AND AUTO CRASH INJURY

by James S. Williams; John C. Balcerak; John D. States; Martin W. Korn; David N. Kluge; Alexander T. Morris

Rochester Univ.

Published in HS-011 284, *American Association for Automotive Medicine Proceedings of Fifteenth Conference,* New York, 1972 p84-96

Contract FH-11-6796; FH-11-7329; FH-11-7422

Presented at the fifteenth conference of the American Assoc. for Automotive Medicine, Colorado Springs, 20-23 Oct 1971.

The case records of 153 motor vehicle accidents studied since March 1968 were reviewed. In 43 cases, compartment collapse was noted. The accidents were catagorized according to the principal part of the car affected: front, side, and roof. Crash characteristics and injury production were compared to determine the role of compartment collapse in injury causation. The role of restraint systems in injury attenuation in each accident type was noted.

Search terms: Accident case reports; Injury causes; Restraint system effectiveness; Collapse; Crashworthy bodies; Roof failures; Rollover accidents; Side impact collisions; Front end collisions; Fatality causes; Injuries by body area

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HS-011 289 Fld. 1/2

INJURIES OF THE THORAX AND OF THE LOWER EXTREMITIES TO FORCES APPLIED BY BLUNT OBJECT

by Klaus H. Burow

Technical Univ. of Berlin (West Germany)

Published in HS-011 284, *American Association for Automotive Medicine Proceedings of Fifteenth Conference,* New York, 1972 p122-50

11refs

Presented at the fifteenth conference of the American Assoc. for Automotive Medicine, Colorado Springs, 20-23 Oct 1971.

In order to design vehicle components that could be safely struck by occupants in a car crash, a research program was undertaken to determine the vulnerability of the thorax and lower extremities to impact force and energy. The load equipment was a twin pendulum; the test subjects were fully articulated unembalmed cadavers. The lower extremity tests simulated a pedestrian struck by a car bumper. It was found that the shaft of the tibia is the most dangerous height for bumpers. The thoracic impact area was at the height of the second to fourth ribs. Fractures and other injuries resulting from impacts in both test areas are tabulated and discussed. It was found that the age of the subject had a direct bearing on the degree of injury sustained.

Search terms: Cadavers in testing; Chest impact tolerances; Impact tests; Injury research; Leg impact tolerances; Fractures; Patella fractures; Chest injuries; Tibia fractures; Injuries by age; Injury severity

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HS-011 290 Fld. 1/2

THE COMPLICATED HEAD INJURIES OF THE UNRESTRAINED CHILD IN AUTO COLLISION

by Fleming L. Jolley

Emory Univ.

Published in HS-011 284, *American Association for Automotive Medicine Proceedings of Fifteenth Conference,* New York, 1972 p168-71

Presented at the fifteenth conference of the American Assoc. for Automotive Medicine, Colorado Springs, 20-23 Oct 1971.

The cases of 61 children hospitalized for neurosurgical evaluation and treatment were reviewed. The most frequent head injury seen in these cases is the closed blunt trauma consisting clinically of a period of unconsciousness with cerebral concussion at the site of the head contact. A relatively small number of children do experience significant brain damage due to unrestricted intercompartment movements. The lack of use of restraint systems is apparent for children with these injuries. It is concluded that recent interior vehicle design improvements have reduced severity of injuries in at least the urban environment.

Search terms: Head injuries; Child injuries; Injury severity; Neurologic manifestations; Restraint system usage; Automobile interior design

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HS-011 291 Fld. 1/2

INJURY EXPOSURES IN A LARGE-SMALL CAR COLLISION

by D. M. Severy; J. D. Baird

California Univ., Los Angeles. Institute of Transportation and Traffic Engineering

1969 54p

1/2 Injuries (Cont'd.)

HS-011 291 (Cont'd.)

An experimental full-scale collision was carried out to obtain original data on the nature of small to large car collisions. The project was carried out by students. Findings indicate that safety standards for small cars must be higher than those which apply to larger cars. Due to the mass differential of smaller cars, the collision exposure suffered by small car occupants when struck by a typical domestic vehicle is significantly greater than that suffered by large car occupants in the identical situation. In addition, the strength and design of passive restraint devices used in vehicles today require significant improvement if they are to approach total protection effectiveness. The test collision involved a domestic car striking the rear of a small foreign car.

Search terms: Rear end collisions; Vehicle vehicle impact tests; Injuries by vehicle size; Compact automobile accidents; Vehicle safety standards; Occupant protection; Passive restraint systems; Vehicle mass; Instrumented vehicles; Anthropometric dummies; Injury probability

1/3 Investigation

HS-011 292 Fld. 1/3

HIGHWAY ACCIDENT ANALYSIS IN CANADA

by J. A. Bancroft

Canada Ministry of Transport

Published in HS-011 284, *American Association for Automotive Medicine Proceedings of Fifteenth Conference,* New York, 1972 p1-7

Presented at the fifteenth Conference of the American Assoc. for Automotive Medicine, Colorado Springs, 20-23 Oct 1971.

This presentation outlines the background for and the organization of the Road and Motor Vehicle Traffic Safety Branch within the Canadian Federal Ministry of Transport and includes the aims, responsibilities, current and proposed team composition, and the progress made to date of the Accident and Defect Investigation Division. Brief details and slide presentation of a typical accident investigation concludes.

Search terms: Canada; Federal role; Accident analysis; Motor Vehicle Safety Act (Canada); Accident investigation; Accident prevention

HS-011 293 Fld. 1/3

THE MAN IN THE STREET-PEDESTRIAN ACCIDENTS IN THE EMPIRE STATE

by A. J. McLean

Harvard School of Public Health

Published in HS-011 284, *American Association for Automotive Medicine Proceedings of Fifteenth Conference,* New York, 1972, p97-122

8refs

Presented at the fifteenth conference of the American Assoc. for Automotive Medicine, Colorado Springs, 20-23 Oct 1971.

New York State pedestrians are involved in 28,000 motor vehicle accidents each year, and 1,000 of these pedestrians receive fatal injuries. This paper presents the results of a study of many of the characteristics of this type of accident, based on punch card resumes of the Department of Motor Vehicles accident reports for the year ending July 1970. A general descriptive outline of host, vehicular, and environmental factors is followed by a demonstration of the relationship between many of these factors and the pedestrian's degree of injury, as assessed by the National Safety Council's A, B, C, D injury severity scale. Examples of interacting effects of several of these factors are presented to emphasize the need for caution before claiming any such relationship to be causal.

Search terms: Pedestrian accidents; Pedestrian age; Age factor in accidents; New York (City); New York (State); Injury severity; Fatality rates; Pedestrian sex; Injury rates; Vehicle characteristics; Accident location; Month; Day of week; Time of accidents; Precrash phase; Vehicle age

HS-011 294 Fld. 1/3; 3/4

HUMAN/PSYCHOLOGICAL FACTORS IN MULTIDISCIPLINARY ACCIDENT INVESTIGATION

by J. Robert Cromack; Thomas R. Williamson

Southwest Res. Inst.

Published in HS-011 284, *American Association for Automotive Medicine Proceedings of Fifteenth Conference,* New York, 1972 p172-200

37refs

Presented at the fifteenth conference of the American Assoc. for Automotive Medicine, Colorado Springs, 20-23 Oct 1971.

The methodology developed by the Southwest Research Institute Multidisciplinary Accident Investigation team for analyzing contributory elements of the human component in a highway collision is identified. To accomplish accurate analysis, detailed and factual demographic, medical, and psychological information is obtained through interviews with the accident participants, and/or their families, friends, neighbors, and employers; assessment of driving, credit, school, and other records; and consultation with appropriate specialists. Useful forms have been developed for reporting such psychological and injury data. The findings for 82 case studies have been summarized with special emphasis given to the role of the human/psyshological factors. Brief case histories are used to illustrate salient points.

Search terms: Multidisciplinary teams; Accident investigation; Southwest Res. Inst.; Human factors; Psychological factors; Driver personality; Medical factors; Driver records; Socioeconomic data; Sociological factors; Drinking drivers; Driver characteristics; Data acquisition; Restraint system usage; Injuries by body area

1/5 Statistical data

HS-011 295 Fld. 1/5

ARE RACING AND SAFETY NATURAL ENEMIES?

by Karl E. Ludvigsen

Motor Racing Safety Society

Published in HS-011 284, *American Association for Automotive Medicine Proceedings Fifteenth Conference,* New York, 1972, p212-22

3refs

Presented at the fifteenth conference of the American Assoc. for Automotive Medicine, Colorado Springs, 20-23 Oct 1971.

The efforts of the Motor Racing Safety Society to provide reliable statistics on motor racing accidents, injuries, and fatalities on a world-wide basis are discussed. It is believed that the availability of such data would help to solve many problems related to the car, the driver, and the highway. Various injury and fatality figures from such sources as the Sports Car Club of America, Dr. Michael Henderson of Great Britain, and Mr. Jules V. Quint of the United States are tabulated. United States auto racing driver fatalities are shown for 1960-1970, and partial ones for 1971.

Search terms: Racing accidents; Fatalities; Injury statistics; Data acquisition; United States; Great Britain

2/0 HIGHWAY SAFETY

2/2 Communications

HS-011 296 Fld. 2/4

THE BRIDGE ABUTMENT PROBLEM

by Horace E. Campbell

Colorado Medical Society

Published in HS-011 284, *American Association for Automotive Medicine Proceedings of Fifteenth Conference,* New York, 1972 p200-11

12refs

Presented at the fifteenth conference of the American Assoc. for Automotive Medicine, Colorado Springs, 20-23 Oct 1971.

Many fatal accidents occur when an automobile strikes a bridge abutment. The most prevalent type of accident on the Interstate Highway System is the single-vehicle accident, in which the vehicle strikes a fixed roadside object or overturns. Currently the most effective protection is placing plastic barrels, partially filled with dry sand, in front of the impact surface. This is more effective than current guard rails. Many, if not most, bridge abutments do not even have guard rails. Further, it is recommended that the base of bridge abutments and central piers facing the roadway be of the same configuration as the General Motors bridge parapet, an adaptation of the New Jersey concrete median barrier.

Search terms: Abutments; Interstate Highway System; Roadside hazards; Ran off road accidents; Impact attenuators; Medians

3/0 HUMAN FACTORS

3/1 Alcohol

HS-011 297 Fld. 3/1

AN EVALUATION OF SOME QUALITATIVE BREATH SCREENING TESTS FOR ALCOHOL

by Brian O'Neill; Richard W. Prouty

Insurance Inst. for Hwy. Safety; North Dakota State Univ.

Published in HS-011 284, *American Association for Automotive Medicine Proceedings of Fifteenth Conference,* New York, 1972 p261-96

11refs

Presented at the fifteenth conference of the American Assoc. for Automotive Medicine, Colorado Springs, 20-23 Oct 1971.

An evaluation of a number of disposable screening devices that are used for qualitative breath testing of blood alcohol concentrations is described. The devices consisted of a breath collection bag or balloon, and a glass tube containing an alcohol-sensitive reagent through which the breath sample was passed. Blood alcohol concentrations were estimated from color changes in the reagent. The results obtained with each disposable screening device were compared with actual blood alcohol concentrations. The frequencies of erroneous results obtained with each device at different ranges of actual blood alcohol concentrations are presented. All of the devices tested were found to produce a high frequency of erroneous results.

Search terms: Alcohol breath tests; Blood alcohol levels; Drinking drivers; Evaluation

3/1 Alcohol (Cont'd.)

HS-011 298 Fld. 3/1

DENVER ALCOHOL SAFETY ACTION PROJECT TREATMENT MODALITIES FOR THE PROBLEM DRINKING DRIVER

by Lois G. Whitley; Richard D. Daetwiler

Colorado Dept. of Health

Published in HS-011 284, *American Association for Automotive Medicine Proceedings of Fifteenth Conference,* New York, 1972 p297-308

> Presented at the fifteenth conference of the American Assoc. for Automotive Medicine, Colorado Springs, 20-23 Oct 1971.

The identification of the drinking driver is one facet of the NHTSA countermeasures program to reduce alcohol related fatalities and crashes. In Denver, the drinking driver has been found to be in an early stage of problem drinking. He is predominately male, less than 35 years old, disproportionately from minority ethnic groups, still has a job and his family is intact. Present treatment modalities are for the middle class alcoholic who responds to insight, group or "talking" therapy. Since this kind of therapy does not meet the needs of the Denver Alcohol Safety Action Project (DASAP) clients, DASAP is developing with the community treatment modalities that will take into account the social class, life style, and cultural background of the clients. Efforts will be directed to control drinking rather than abstinence as a treatment goal. Success will be determined by evidence of separation of abusive drinking and driving.

> Search terms: Drinking drivers; Driver social class; Driver characteristics; Driver rehabilitation; Social drinking; Alcoholism; Alcohol usage deterrents; Alcohol Safety Action Projects; Denver

3/2 Anthropomorphic Data

HS-011 299 Fld. 3/2

SAE CONTROLS REACH STUDY

by David C. Hammond; Ronald W. Roe

Ford Motor Co.; General Motors Corp.

1972 22p 22refs
Report no. SAE-720199

> Presented at Automotive Engineering Congress, Detroit, 10-14 Jan 1972.

This report presents the results of the SAE Human Factor Committee Driver Control Reach Study conducted in June-August 1971. Over 100 test subjects were measured on three test fixtures representing a sports car, a typical passenger car, and a heavy truck. Finger grasp reach was recorded to 40 locations in front of the driver. The report presents the background information for a forthcoming SAE Recommended Practice on Driver Arm Reach.

> Search terms: Ergosphere; Hand motion range; Arm motion range; Control location; Truck cab interiors; High powered automobiles; Automobiles; Anthropometry; Mathematical models; Human body segment parameters; Foot motion range

AVAILABILITY: SAE

HS-011 300 Fld. 3/2; 3/12

DRIVER HEAD AND EYE POSITIONS

by David C. Hammond; Ronald W. Roe

Ford Motor Co.; General Motors Corp.

1972 16p 11refs
Report no. SAE-720200

> Presented at Automotive Engineering Congress, Detroit, 10-14 Jan 1972.

Results of previous SAE drivers' eye-location studies have been used to develop a fixed seat eyellipse and contours that describe drivers' head locations. Centroid data from these and other eye-location studies are used as a means of locating the SAE eyellipse according to seat back angle. Part I comprises the discussion of these data. Studies recently completed provided data on drivers' eye locations for varied vehicle packages ranging from sports cars to heavy trucks. The results are summarized in Part II as a series of tables, which include statistical definitions of tangent cutoff eyellipses. Part I of this report describes a method for positioning a fixed seat eyellipse according to seat back angle. A method is also shown for measuring headroom relative to seat back angle.

> Search terms: Anthropometry; Head motion range; Head movement; Eyellipse; Eye location; Eye movements; Eye research; Seat backs; Ergosphere; Mathematical models

AVAILABILITY: SAE

HS-011 301 Fld. 3/2; 5/4

HUMAN FACTORS ANALYSIS OF CURRENT AUTOMOBILE CONTROL/DISPLAY CHARACTERISTICS

by Henry S. R. Kao; Thomas B. Malone; Richard L. Krumm

Essex Corp.

1972 11p 2refs
Report no. SAE-720204

> Presented at Engineering Congress, Detroit, 10-14 Jan 1972.

This paper reports an analysis of the degree of control/display (C/D) standardization in location, operation, and coding characteristics for 1971 automobiles. For C/D location commonality, between-manufacturer and within-manufacturer and between-car-type designs were compared. For operation and coding analysis, a selected group of

C/D was used. With 90% of domestic and
76% of imported cars surveyed, a great
ariability of C/D designs was found for
ll three measures. The second part of
he study experimentally evaluated four
lternate control concepts for passenger
ar three-beam headlight systems.

Search terms: Control equipment; Display systems; Automobile models; Foreign automobiles; Control location; Coding systems; Headlamp design; Human factors engineering; Standardization

VAILABILITY: SAE

/4 Driver Behavior

S-011 302 Fld. 3/4

DENTIFICATION OF CON-
ROLS: A STUDY OF SYMBOLS

y Daniel D. Jack

ord Motor Co.

972 7p 4refs
eport no. SAE-720203

Presented at Automotive Engineering Congress, Detroit, 10-14 Jan 1972.

ne development of a procedure to
aluate the driver's ability to identify
d attach meaning to automotive con-
ol identification symbols is outlined,
gether with the test results of Step 1
a 3-step procedure. The use of a
andardized test methodology is es-
ntial in arriving at any standard set of
mbols which are expected to have a
gh potential for immediate under-
anding by the driving population. The
even controls evaluated were: head-
mps, turn signals, windshield wipers
d washers, chokes, emergency flashers,
garette lighters, fans, air vents, radio
lume, and radio tuners.

Search terms: Symbols; Coding sys-
ems; Character recognition; Form perception; Intelligibility; Pattern recognition; Control equipment; Driver behavior research; Headlamps; Turn signals; Windshield wipers; Windshield washers; Chokes; Flashing warning signals; Fans; Smoking; Ventilating systems; Radios

AVAILABILITY: SAE

HS-011 303 Fld. 3/4

A THEORY OF DRIVER MOTIVATION. PHASE TWO THE RESULTS OF STRUCTURED GROUP INTERVIEWS WITH CIVIC AND SERVICE CLUB GROUPS: TRAFFIC SAFETY VIEWS OF OLDER DRIVERS

by Charles B. Stoke

Virginia Hwy. Res. Council

1971 23p
Report no. VHRC-70-R46

In cooperation with Federal Highway Administration

About 300 members of civic and service groups were interviewed on traffic safety and their views compared to those of 500 high school students interviewed in a previous study. The interview questions dealt with why subjects wanted to drive, what restricts freedom of action in a car, what they thought of driver education, what they thought caused accidents and how these could be prevented, how fast they wanted to drive, and what improvements were needed to highways. Similarities and differences in opinions for the adults and the high school students are described.

Search terms: Highway safety; Automobile cultural role; Adult drivers; High school drivers; Driver interviews; Driver motivation; Driver attitudes; Driver education evaluation; Highway improvements; Accident causes; Accident prevention; Speed patterns

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3/5 Driver Education

HS-011 304 Fld. 3/5

DEVELOPMENT OF AN "ADVANCED"/DRIVER EDUCATION PROGRAM

by F. D. Smithson

General Motors Corp.

Published in HS-011 284, *American Association for Automotive Medicine Proceeding, of Fifteenth Conference*, New York, 1972 p351-60

Presented at the fifteenth conference of the American Assoc. for Automotive Medicine, Colorado Springs, 20-23 Oct 1971.

An advanced driver education program developed at General Motors Proving Ground is described. The program is designed around the concept of training drivers to handle specific driving emergencies that accident causation data indicate to be problems. The individual training exercises are discussed, and data are presented for an evaluation program conducted to assess the value of the training methods.

Search terms: Driver education; Emergency training; Driver education evaluation; Driver emergency responses; Accident avoidance

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HS-011 305 Fld. 3/5

DRIVER EDUCATION PROGRAMMING

Michigan. Dept. of Education

n.d. 178p

This driver education manual is for use by local school districts. Most of the material is general and can be adapted for use with any approved driver education textbook. Included are: the

3/5 Driver Education (Cont'd.)

HS-011 305 (Cont'd.)

Michigan driver education law; driver education course outlines, lesson plans, films, tests; materials and equipment sources; scheduling techniques; and curriculum.

> Search terms: Driver education manuals; Driver education laws; Driver education costs; Michigan; Instruction materials; Curricula; High school driving courses

3/8 Environmental Effects

HS-011 306 Fld. 3/8; 3/1; 1/3

CARBON MONOXIDE, SMOKING, AND FATAL HIGHWAY CRASHES

by Julian A. Waller; Kenneth Thomas

Vermont Univ.

Published in HS-011 284, *American Association for Automotive Medicine Proceedings of Fifteenth Conference,* New York, 1972 p245-60

22refs
Contract FH-11-6609; FH-11-6899

> Presented at the fifteenth conference of the American Assoc. for Automotive Medicine, Colorado Springs, 20-23 Oct 1971.

Carbon monoxide in concentrations above 15% in the blood appears only rarely to be a factor in highway crashes. However, carbon monoxide in lower concentrations, and cigarette smoking which can produce such concentrations, have been hypothesized as important hazards to safe driving and one study has reported that smokers have higher crash rates than do non-smokers. In the present study, however, fatally injured drivers had evidence of heavy smoking more often than did drivers not involved in crashes but stopped at roadblocks at times and places where crashes had occurred. But the entire excess was attributable to the fact that heavy smokers also are heavy drinkers, and often are problem drinkers. Persons who smoke heavily but do not drink heavily were not over-represented among the fatalities. It is hypothesized that problem drinkers represent a substantial proportion of persons with chronic respiratory disease just as they do among highway fatalities.

> Search terms: Carbon monoxide; Smoking; Accident causes; Blood alcohol levels; Drinking drivers; Males; Females; Carboxyhemoglobin; Fatalities

3/9 Impaired Drivers

HS-011 307 Fld. 3/9

EVALUATION OF CARDIAC PATIENTS WITH ISCHEMIC HEART DISEASE FOR MOTOR VEHICLE DRIVING

by Jan J. Kellermann; I. Kariv; David Lederman; Bernard Wortreich; Barry Griffith King

Published in HS-011 284, *American Association for Automotive Medicine Proceedings of Fifteenth Conference,* New York, 1972, p376-87

15refs

> Presented at the fifteenth conference of the American Assoc. for Automotive Medicine, Colorado Springs, 20-23 Oct 1971.

Laboratory and driving tests have been conducted on 158 drivers with ischemic heart disease, including myocardial infarction, angina pectoris, and coronary insufficiency. Tests of 201 control subjects were also made. Laboratory evaluations of the functional condition of examinees included multistate ergometry to determine submaximal physical work capacity, defined as the greatest workload at which the patient is able to perform in a steady state under aerobic conditions during the last 2½ minutes of a 5-minute effort. Psychological evaluation was also made. Evaluation while driving included ECG, blood pressure, and pulse rates. Notes were taken on details such as overtaking, sudden stops, curves, and being stopped by police. Findings on the control subjects and those with ischemic heart disease are compared.

> Search terms: Laboratory tests; Driver tests; Driving task analysis; Driver physical fitness; Heart diseases; Myocardial infarct; Angina pectoris; Psychological tests; Heart rate; Ischemia; Cerebrovascular insufficiencies; Electrocardiograms; Biomedical monitoring; Workload measurements; Blood pressure

3/11 Pedestrians

HS-011 308 Fld. 3/11; 1/2; 4/7

PEDESTRIAN IMPACT CASE STUDY

by David N. Schmidt; Donald A. Nagel

Stanford Univ.

Published in HS-011 284, *American Association for Automotive Medicine Proceedings of Fifteenth Conference,* New York, 1972, p151-167

> Presented at the fifteenth conference of the American Assoc. for Automotive Medicine, Colorado Springs, 20-23 Oct 1971.

An analysis of the unusual survival of a pedestrian impacted by an automobile traveling in excess of 40mph was undertaken by Stanford Crash Analysis Team. The pedestrian received extremely serious injuries. Her survival is due to prompt emergency treatment initiated within ten minutes of her injury. Her dynamics were modeled in an analysis concerend with her vault through the air and slide to rest on road surface. Long and short term efforts to implement her recovery and identify her specific injuries are thoroughly documented from both medical and orthopedic studies.

Search terms: Pedestrian accidents; Pedestrian injuries; Medical treatment; Accident analysis; Internal injuries; Mathematical analysis; Accident survivability; Accident case reports; Medical case reports; Human body impact tolerances; Pedestrian dynamics

3/12 Vision

HS-011 309 Fld. 3/12; 1/2

OCULAR MANIFESTATIONS OF WHIPLASH INJURIES

by P. D. Roca

Rochester Univ.

Published in HS-011 284, *American Association for Automotive Medicine Proceedings of Fifteenth Conference,* New York, 1972 p308-19

24refs

Presented at the fifteenth conference of the American Assoc. for Automotive Medicine, Colorado Springs, 20-23 Oct 1971

The ocular manifestations of whiplash injuries in 16 patients were amaurotic episodes, decreased accommodation and convergence, decreased prism vergence power, anisocoria, diplopia, light sensitivity, extraocular muscle imbalances, ptosis, possible vitreous detachment, tearing. Management and prognosis are considered as well as the role of pathogenetic factors in the production of the syndrome.

Search terms: Whiplash injuries; Vision disorders; Visual degradation; Brain concussion; Medical treatment

HS-011 310 Fld. 3/12

ROLE OF PERIPHERAL VISION AND TIME SHARING IN DRIVING

by Vivek D. Bhise; Thomas H. Rockwell

Ohio State Univ.

Published in HS-011 284, *American Association for Automotive Medicine Proceedings of Fifteenth Conference,* New York, 1972 p320-41

22refs

Presented at the fifteenth conference of the American Assoc. for Automotive Medicine, Colorado Springs, 20-23 Oct 1971.

The role of extra-foveal and foveal vision in the visual information acquisition process of the driver, and the effect of a driver's visual information acquisition behavior on his driving performance are investigated. It was found that drivers acquire considerable amounts of information through extra-foveal vision for both lateral and longitudinal control performance. Foveal vision, because of its finer descrimination capabilities, can process information more accurately and at higher speeds, but it covers only a small portion of the total visual field available to a driver. The results obtained in this experiment have implications in many design problems where degradation in both lateral and longitudinal control performance is critical and a number of other spatially separated tasks such as reading side-mounted signs and judging motion characteristics of merging vehicles exist.

Search terms: Central vision; Peripheral vision; Road tests; Test equipment; Eye movements; Driver performance; Design of experiments; Driving tasks; Visual fields

HS-011 311 Fld. 3/12; 3/5

IMPROVING VISUAL RECOGNITION AND RESPONSE TO COLLISION PRODUCING SITUATIONS THROUGH USE OF A TACHISTOSCOPIC PROCESS

by Keith Edward Barenklau

Employers Insurance of Wausau

Published in HS-011 284, *American Association for Automotive Medicine Proceedings of Fifteenth Conference,* New York, 1972 p342-50

14refs

Presented at the fifteenth conference of the American Assoc. for Automotive Medicine, Colorado Springs, 20-23 Oct 1971.

In order to shed more light on safe driving as a visually connected rational process, an experiment was undertaken to determine if the driver's ability to perceive and deal with pending collisions could be taught in a classroom situation using projected three-dimensional traffic interaction scenes. Three null hypotheses were tested: that drivers with visual training do not recognize pending collisions more accurately; that drivers with visual training recognize no greater quantity of collision-producing situations; and that drivers trained with three-dimensional slide images recognize pending collisions no more accurately than when two-dimensional images are used. The null hypotheses were rejected in the study results. The present emphasis on manipulative skills in driving should be altered to a more visually connected decision-making process.

Search terms: Driving task analysis; Classroom driver instruction; Accident avoidance; Defensive driving; Hazard perception; Collision courses; Driver skills; Decision making; Visual perception; Visual aids

HS-011 312 Fld. 3/12; 1/3

NIGHTVISION AND ACCIDENT INVOLVEMENT

by Walter J. Gerstle; Louise Kuziomko; Charles W. Bostick

New York (State) Dept. of Motor Vehicles

Published in HS-011 284, *American Association for Automotive Medicine*

3/12 Vision (Cont'd.)

HS-011 312 (Cont'd.)

Proceedings of Fifteenth Conference, New York, 1972, p361-75

Presented at the fifteenth conference of the American Assoc. for Automotive Medicine, Colorado Springs, 20-23 Oct 1971.

An automatic device, the ZEISS Recording-Nyctometer, was used to study night vision, glare vision, and glare recovery. A pilot group of 400 was tested, a questionnaire administered, and an abstract of their driving history obtained. The data indicate that night vision scores cannot be used to predict glare sensitivity scores and vice versa, that nyctometer test scores deteriorate with increasing age, and that glare recovery scores are related to sex. Further, there is a connection between accident and conviction history and nyctometer test scores. It was also noted that many subjects overrestimated their night vision and glare recovery. No significant difference was found in the test scores of smokers and non-smokers.

Search terms: Vision tests; Vision age changes; Visual degradation; Night vision; Questionnaires; Driver records; Age factor in driving; Sex factor in driving; Smoking; Glare tolerances; Glare recovery; Glarometers; Problem drivers; Accident repeater drivers; Traffic law violators; Male drivers; Female drivers

HS-011 313 Fld. 3/12; 3/2

COMPARISON OF STATIC AND DYNAMIC DRIVER EYE POSITION IN VARIOUS PASSENGER VEHICLES

by William J. Burger

Dunlap and Associates, Inc.

1972 18p 8refs
Contract FH-11-7819
Report no. SAE-720201

Presented at Automotive Engineering Congress, Detroit, 10-14 Jan 1972.

Cyclopean eye positions of a small selected sample of drivers were measured relative to vehicle reference points while they performed usual driving activities in several late model vehicles. One vehicle was modified to obtain enhanced lateral and rear visibility. Results indicate that during driving, eye position shifts substantially to the rear of static eye position; shoulder belts restrict eye excursions even during straight ahead driving; a periscopic type mirror eliminates eye position shift and reduces variability during lane changes when compared to standard rear vision devices; there is no consistent change in eye position over extended periods of driving; and driving environment does not significantly affect average eye position.

Search terms: Eye location; Eye movements; Eye research; Driving task analysis; Shoulder harnesses; Lane changing; Automobile models; Periscopic rearview mirrors; Rear visibility; Anthropometrry; Mathematical models

AVAILABILITY: SAE

4/0 OTHER SAFETY RELATED AREAS

4/8 Transportation Systems

HS-011 314 Fld. 4/8

AUTOMOBILE AND PUBLIC TRANSPORTATION FOR RETIRED PEOPLE

by Frances M. Carp

Published in *Highway Research Record* n348 p182-91 (1971)

19refs

Sponsored by Committee on Passenger and Freight Transportation Characteristics and presented at the 50th annual meeting of the Highway Research Board.

This study is concerned not so much with the problems created by the older driver as with the problems he experiences and the extent to which driving facilitates personal satisfaction and social contribution during the retirement years. A 1.3% sample of the retired population of San Antonio was interviewed to determine how many retired people drive, where and how often, what problems they experience, how mobility is limited, how many do not drive, and what effects not driving have on personal fulfillment and social contribution. It was concluded that most retired people do not have cars, that public transportation is inadequate for them, and that inability to drive leaves them marooned at home.

Search terms: Aged; Aged drivers; Automobile cultural role; Sociological factors; Interviews; San Antonio; Public transportation; Transportation of aged; Trip frequencies; Trip geography; Travel patterns

HS-011 315 Fld. 4/8

USER ATTITUDE SURVEYS AND TRANSPORTATION SYSTEM DEVELOPMENT

by Herbert J. Bauer

General Motors Corp.

1972 14p 30refs
Report no. SAE-720176

Presented at Automotive Engineering Congress, Detroit, 10-14 Jan 1972.

This paper deals with a new concept of transportation system development based on well-established psychophysical principles. It reviews briefly the traditional method of transportation system development and modification. The point is made that it now becomes necessary to reverse the usual trend of declining public transportation system usage. The "new philosophy" of system development utilizing user-oriented techniques in the form of attitude surveys is presented as a possible aid in enhancing public transit use. As an exemplar to illustrate four techniques (paired comparison, semantic scaling, branch-and-bounds interview, and document attitude analysis) the methods and some representative data of General Motors Research Laboratories Transportation Research Department case study of a door-to-door (demand-actuated) public transportation system are discussed. It is prognosticated that the use of survey-type techniques to measure both user and nonuser attitudes will increase in transportation system development.

Search terms: Public transportation usage; Demand scheduled buses; Transportation studies; Transportation problems; Psychophysical discrimination; Interviews; Opinion polls; Consumer attitudes; Semantics; Statistical analysis; Market surveys; Data acquisition

AVAILABILITY: SAE

5/0 VEHICLE SAFETY

5/4 Design

HS-011 316 Fld. 5/4

NEW NONDESTRUCTIVE TESTS FOR THE AUTOMOTIVE INDUSTRY

by Robert C. McMaster

Ohio State Univ.

1972 7p
Report no. SAE-720171

Presented at Automotive Engineering Congress, Detroit, 10-14 Jan 1972.

New methods of nondestructive testing applicable to automotive industries include xeroradiography, a high-speed, low-cost method of x-ray inspection without use of films or darkroom processing, for tires, plastic parts, welds, and castings; optical holographic nondestructive tests for detection of anomalies and lack of bond in tires; magnetic field tests which measure hardness (or case depth) in engine parts, steering knuckles, and door hinges or latches; x-ray television systems which permit direct, in-motion viewing of plastic, metallic, and tire assemblies; and advanced eddy current test systems with a variety of sorting, dimensional control, and defect-detection capabilities. These supplement presently available methods such as film radiography, magnetic particle, liquid-penetrant, ultrasonic, and visual inspection, and sampling destructive tests, in quality control for reliability in the automotive manufacturing industries. Further needs for nondestructive tests in the automotive industry include development and application of high-speed, low-cost, automated evaluation test systems which can be incorporated into production lines and operate unattended over long periods. There is need for nondestructive test systems adequate to ensure the manufacturer against liability arising from defective components, designed to provide automatic feedback control of production processes and to eliminate unserviceable components before these can be assembled into automobiles and trucks.

Search terms: Nondestructive tests; Manufacturing inspection; Quality control; X ray analysis; Holographic interferometry; Television in testing; Radiography; Test equipment; Automated inspection equipment; Electronic monitoring systems; Defective products; Defect correction; Automotive parts; Automotive industry

AVAILABILITY: SAE

HS-011 317 Fld. 5/4

ADVANCED NONDESTRUCTIVE TESTING METHODS FOR BEARING INSPECTION

by John R. Barton; James Lankford, Jr.; P. L. Hampton

Southwest Research Inst.; Air Force Logistics Command

1972 17p 22refs
Report no. SAE-720172

Presented at Automotive Engineering Congress, Detroit, 10-14 Jan 1972.

The principles of the magnetic-perturbation method of flaw detection and the Barkhausen noise residual stress measurement method are briefly reviewed. It is suggested that they provide very powerful tools for assuring improved ball bearing performance. The methods are applied for the evaluation of ball bearing races. Typical experimental results are presented along with metallurgical sectioning correlation.

Search terms: Bearing tests; Nondestructive tests; Quality control; Magnetic properties; Perturbation; Residual stress measurement; Metal working; Acoustic measurement; Manufacturing inspection

AVAILABILITY: SAE

HS-011 318 Fld. 5/4

IDENTIFICATION OF CONTROLS: BACKGROUND AND APPROACH

by Peter Kyropoulos

Society of Automotive Engineers, Inc.

1972 16p 7refs
Report no. SAE-720202

Presented at Automotive Engineering Congress, Detroit, 10-14 Jan 1972.

The history and technical background of the SAE Subcommittee (of the Human Factors Committee) on Control Identification is reviewed. Recommendations are presented for a proposed SAE Information Report on Recommended

5/4 Design (Cont'd.)

HS-011 318 (Cont'd.)

Practice on *Identification of Controls for Passenger Cars,* with particular emphasis on guidelines for the development of new identifications.

Search terms: Control equipment; Standardization; Control location; Symbols; Coding systems; Visual coding; Shape coding; Color coding; Human factors engineering

AVAILABILITY: SAE

5/6 Fuel Systems

HS-011 319 Fld. 5/6

A STUDY OF TWO-STROKE CYCLE FUEL INJECTION ENGINES FOR EXHAUST GAS PURIFICATION

by Giichi Yamagishi; Tadanori Sato; Hiroyoshi Iwasa

Fuji Heavy Industries Ltd. (Japan)

1972 21p 4refs
Report no. SAE-720195

Presented at Automotive Engineering Congress, Detroit, 10-14 Jan 1972.

A fuel direct-injection system was applied to a 2-stroke engine for the purpose of reducing exhaust gas emissions, especially exhaust hydrocarbons. It was observed that fuel injection only, as an alternative to the carburetor, was not an adequate means for exhaust gas purification. Therefore, a combined throttle and spark timing control device and a thermal reactor were also adopted. On an automotive injection engine with a swept volume of 21.7 in^3, these changes succeeded in reducing hydrocarbons to 5 ppm and carbon monoxide to 0.21% in the Japanese four-mode test. The durability of the thermal reactor is not yet adequate.

Search terms: Fuel injection; Two stroke cycle engines; Exhaust emission control devices; Hydrocarbons; Carburetors; Exhaust gases; Spark timing; Throttles; Carbon monoxide; Thermal reactors; Exhaust emission tests; Engine speeds; Mathematical models

AVAILABILITY: SAE

HS-011 320 Fld. 5/6

DEVELOPING A NEW STRATIFIED-CHARGE COMBUSTION SYSTEM WITH FUEL INJECTION FOR REDUCING EXHAUST EMISSIONS IN SMALL FARM AND INDUSTRIAL ENGINES

by Masataka Miyake

Mitsubishi Heavy Industries Ltd. (Japan)

1972 17p 5refs
Report no. SAE-720196

Presented at Automotive Engineering Congress, Detroit, 10-14 Jan 1972.

This paper describes a new stratified-charge combustion system called the Mitsubishi Combustion Process, accomplished by controlling the air swirl and improving the injection nozzle in regulating fuel injection, which reduces poisons from exhaust emissions of small engines. Experiments proved that the MCP engine reduces the emission level; for example, with gasoline the concentrations of HC, CO, and NO are 80 ppm, 0.20%, and 600 ppm, respectively, at the rated horsepower. The engine shows excellent performance in multifuel and starting characteristics. The improvement of spray formation that has an important effect on exhaust emissions and other engine performance is also described.

Search terms: Engine size; Stratified charge engines; Exhaust emission control; Hydrocarbons; Carbon monoxide; Nitrogen oxides; Fuel injection; Fram vehicles; Industrial trucks; Combustion chamber swirl; Engine performance; Engine operating conditions; Combustion chamber design; Fuel sprays; Air fuel ratio; Mathematical models

AVAILABILITY: SAE

HS-011 321 Fld. 5/6

EXHAUST EMISSIONS FROM SMALL, UTILITY, INTERNAL COMBUSTION ENGINES

by B. H. Eccleston; R. W. Hurn

Bureau of Mines (U.S. Dept. of Interior)

1972 10p 3refs
Report no. SAE-720197

Presented at Automotive Engineering Congress, Detroit, 10-14 Jan 1972.

This material reports findings of an exploratory experimental study designed to add information on the contribution to air pollution of exhaust emissions from small, utility engines, and to evaluate the procedures used to test small engines. Gross measurements of hydrocarbon, carbon monoxide, and nitric oxide are reported for 29 4-cycle and 7 2-cycle engines; sizes of the engines ranged 2-22 hp. Emission measurements were made on each engine for nine combinations of load and air-fuel adjustments; only one speed point —full governed—was covered in the tests. Test procedures are described. An overall average of the data indicate that, operated at full-load and optimum air-fuel ratio, the 4-cycle engines emitted about 8 g HC, 180 g CO, and 5 g NO_2 per horsepower-hour. Under comparable conditions, the 3-6 hp 2-cycle engines emitted an average of 140 g HC, 240 g CO, and 2 g NO_2 per horsepower-hour.

Search terms: Engine size; Engine tests; Hydrocarbons; Carbon monoxide; Nitric oxide; Air fuel ratio; Engine speeds; Engine operating conditions; Internal combustion engines; Exhaust emissions measurement

AVAILABILITY: SAE

HS-011 322 Fld. 5/6

SMALL ENGINE EXHAUST EMISSIONS AND AIR QUALITY IN THE UNITED STATES. REPORT OF THE SAE SMALL ENGINE EMISSIONS SUBCOMMITTEES

by J. A. Donohue; G. C. Hardwick; H. K. Newhall; K. S. Sanvordenker; N. C. Woelffer

Outboard Marine Corp.; International Harvester Co.; Wisconsin Univ.; Tecumseh Products Co.; Jacobsen Manufacturing Co.

1972 14p 9refs
Report no. SAE-720198

Presented at Automotive Engineering Congress, Detroit, 10-14 Jan 1972.

This paper describes the work of the Small Engine Emissions Subcommittee of the SAE Engine Committee in determining the characteristics of emissions from small utility engines. The study concentrated on utility and off-highway vehicle engines (for example, lawn and garden equipment), not motorcycles. Results of the study indicate that emissions from garden type engines presently constitute less than 1% of the total from all United States sources. Although the data are less reliable on large two-cycle engines such as snowmobiles, there is an indication that such vehicles may contribute a disproportionately large share of the total small engine hydrocarbons. A test procedure for the measurement of small engine exhaust emissions is included.

Search terms: Air pollution emission factors; Vehicle air pollution; Engine size; Off the road vehicles; Garden tractors; Hydrocarbons; Snowmobiles; Exhaust emission tests; Engine tests; Air quality standards; Carbon monoxide; Nitric oxide; Engine operating conditions; Two stroke cycle engines

AVAILABILITY: SAE

HS-011 323 Fld. 5/6

APPLICATION OF A MONEL-PLATINUM DUAL-CATALYST SYSTEM TO AUTOMOTIVE EMISSION CONTROL

by R. S. Lunt; L. S. Bernstein; E. L. Holt; J. G. Hansel

Esso Res. and Engineering Co.

1972 17p 5refs
Report no. SAE-720209

Presented at Automotive Engineering Congress, Detroit, 10-14 Jan 1972.

A dual-catalyst-equipped test vehicle, containing Monel catalysts for the reduction of oxides of nitrogen followed by platinum oxidation catalysts, has controlled emissions of carbon monoxide, hydrocarbons, and oxides of nitrogen to levels of 8.0, 0.4, and 0.8 g/mile, respectively, using the single-bag 1972 federal test procedure. The durability of Monel is a major problem. The mechanism of Monel strength loss, currently the limiting factor in catalyst life, was shown to be grain-boundary widening due to alternate oxidation-reduction reactions undergone by the metal. Reinforcement of Monel by an oxidation-resistant metal, particularly when accompanied by fabrication into a unitary structure, significantly improves strength and maintenance of low pressure drop. However, durability equivalent to 50,000 miles of vehicle operation has not yet been demonstrated.

Search terms: Dual bed catalyst systems; Exhaust emission control devices; Carbon monoxide; Hydrocarbons; Nitrogen oxides; Platinum; Monel; Catalysts; Performance tests; Durability tests; Laboratory tests

AVAILABILITY: SAE

HS-011 324 Fld. 5/6

THE EFFECT OF FUEL AND VEHICLE VARIABLES ON POLYNUCLEAR AROMATIC HYDROCARBON AND PHENOL EMISSIONS

by George P. Gross

Esso Res. and Engineering Co.

1972 21p 29refs
Report no. SAE-720210

Presented at Automotive Engineering Congress, Detroit, 10-14 Jan 1972.

Exhaust emission of polynuclear aromatic hydrocarbons (PNA) and of phenols has been studied with a variety of test fuels, using cyclic tests in five vehicles including one without emission control (NC), two with engine-modification (EM) control, and two with experimental very-low-emission systems. The experimental systems both reduced phenol emission to less than 0.5%, and PNA emission to about 1%, of the levels observed in the NC vehicle. Phenols were reduced 30% by one EM vehicle, but not by the other EM vehicle, while PNA emissions were reduced by 70% in both EM vehicles. Fuel composition influenced emissions both directly and through engine deposits. Direct effects included increased phenol emission from increased fuel aromatics and, generally, increased PNA emission from increased fuel aromatics, from increased fuel PNA, and from the presence of a high-boiling naphtha. However, these direct effects of fuel composition on emissions generally decreased, in both relative and absolute terms, in the emission-controlled vehicles. The PNA emissions from several test fuels differed by a factor of two between engine deposits formed from two different commercial premium gasolines. High PNA emissions occurred with deposits from a fuel containing lead and phosphorus; and unleaded fuel, of different hydrocarbon composition and without phosphorus, gave low-emission deposits, but this same fuel, with lead added at 0.5 g./gallon, still gave low emission. The exact fuel factors are not clear at this time. This work was jointly sponsored by the Coordinating Research Council, Inc., and the Environmental Protection Agency.

5/6 Fuel Systems (Cont'd.)

HS-011 324 (Cont'd.)

Search terms: Hydrocarbons; Phenols; Exhaust emission tests; Engine tests; Exhaust emission control devices; Engine modification; Fuel composition; Engine deposits; Engine operating conditions; Aromatic compounds; Lead free gasoline; Leaded gasoline

AVAILABILITY: SAE

HS-011 325 Fld. 5/6; 4/5

DYNAMIC COMPUTER TECHNIQUES FOR VEHICLE EMISSION DEVELOPMENT

by Donald L. Stivender; Y. George Kim

General Motors Corp.

1972 11p 3refs
Report no. SAE-720211

Presented at Automotive Engineering Congress, Detroit, 10-14 Jan 1972.

Development of engine-vehicle prototypes for low emissions and optimum fuel control characteristics has been facilitated through use of a computerized emissions test system. Simultaneous on-line sampling of exhaust species concentrations, fuel consumption, spark advance, pressures, and temperatures provides both graphical and computed outputs of several vehicle parameters that are important to development programs. On-line display of vehicle air-fuel ratio is continuously supplied. Either of two federal driving cycles (or any random driving schedule) may be employed. Dynamic calibration, range sensing, and zero-drift correction keep operator interaction and errors to a minimum. Capability for reprocessing, plotting, and/or patching stored data provides increased computational flexibility.

Search terms: Exhaust emission tests; Air fuel ratio; Engine design; Automobile design; Computerized test methods; Calibration; Computer programs; Exhaust emissions sampling; Fuel consumption; Spark timing; Operating pressure; Operating temperature; Mathematical models

AVAILABILITY: SAE

5/9 Inspection

HS-011 326 Fld. 5/9

WEAK POINTS OF CARS. PERIODIC INSPECTIONS OF PRIVATE CARS DURING THE FIRST QUARTER OF 1971. SEPARATE ACCOUNT OF THE FAULTS IN 1969 AND 1965 MODELS

Svensk Bilprovning A. B.

1971 145p

Statistics are presented on 634,091 vehicles inspected, of which about 90% were private cars. A statistical analysis was made of 21,376 inspection records selected at random to draw conclusions on types of defects. Of the vehicles inspected, 34.9% were passed with clean records, 42% had minor faults, and 23.1% were failed. Statistics are given on each make of vehicle inspected.

Search terms: Defective vehicles; Automobile defects; Vehicle inspection; Sweden; Inspection records; Statistical analysis; Automobile models

5/14 Occupant Protection

HS-011 327 Fld. 5/14; 1/2

RESTRAINT SYSTEM EFFECTIVENESS

by W. D. Nelson

General Motors Corp.

Published in HS-011 284, *American Association for Automotive Medicine Proceedings of Fifteenth Conference*, New York, 1972 p27-46

5refs

Presented at the fifteenth Conference of the American Assoc. for Automotive Medicine, Colorado Springs, 20-23 Oct 1971.

Actual field collision vehicles are illustrated with the details of the lap and shoulder restrained occupants to support the theme that properly used lap and shoulder restraint systems can reduce injury severity in automobile collisions. Presently, approximately 40% of the passenger cars registered in the United States are equipped with lap and shoulder belt systems, but few persons use them. The motoring public is apt to assume a false sense of security during the transitory years of change to passive restraint systems because of lack of public awareness campaigns to "buckle up." This, in turn, is apt to result in a decreased use of voluntary restraints and, therefore, an increased injury risk. The consequence could result in a reversal of the current downward injury trend.

Search terms: Accident case reports; Shoulder harnesses; Seat belts; Restraint system effectiveness; Injuries by body area; Injury severity; Three point restraint systems; Restraint system usage; Photographs

HS-011 328 Fld. 5/14

INCREASED SEAT BELT-SHOULDER HARNESS USAGE BY A STARTER INTERLOCK SYSTEM

by Charles H. Pulley

Irvin Industries, Inc.

Published in HS-011 284, *American Association for Automotive Medicine*

Proceedings of Fifteenth Conference, New York, 1972 p222-30

Presented at the fifteenth conference of the American Assoc. for Automotive Medicine, Colorado Springs, 20-23 Oct 1971.

A simple, inexpensive device that makes it impossible to start the car unless the seat belt and/or shoulder harnesses in all occupied seats are fastened is briefly described. It is estimated that the present usage rate of about 33% for lap belts and less than 5% for shoulder harnesses can be dramatically increased with resultant reduction in deaths and injuries, if all cars were equipped with this device. It has been approved by NHTSA as an acceptable alternative to the passive restraint system until August 1975. It is urged that this system be used until passive restraints have been adequately tested or a better system found.

Search terms: Ignition restraint system interlocks; Restraint system usage; Three point restraint systems; Injury prevention

5/15 Propulsion Systems

HS-011 329 Fld. 5/15; 5/20

THE DEVELOPMENT OF ELECTRIC TRANSPORT VEHICLES OF SELF-SUPPORTING PLASTIC SANDWICH CONSTRUCTION

by H. G. Raschblichler

Messerschmitt-Bolkow-Blohm Gmbh (Germany)

1972 51p
Report no. SAE-720187

Presented at Automotive Engineering Congress, Detroit, 10-14 Jan 1972.

Development of an innovative electric transport vehicle is described. The specific advantages of plastic sandwich construction are illustrated, and a short survey of the production technology and material behavior is given. The propulsion and control concept and the design of the energy source are described. Test results obtained with the prototype in a year of testing and an automated data processing system for evaluating test results are discussed. Other aspects included are battery changing technique and vehicle operating costs.

Search terms: Electric trucks; Plastics; Truck tests; Vehicle operating costs; Battery life; Batteries; Truck design; Data processing

AVAILABILITY: SAE

HS-011 330 Fld. 5/15

SUNDANCER: A TEST BED ELECTRIC VEHICLE

by Robert S. McKee; Boris Borisoff; Frank Lawn; James F. Norberg

McKee Engineering; Tork-Link Corp.; ESB Inc.

1972 8p 4refs
Report no. SAE-720188

Presented at Automotive Engineering Congress, Detroit, 10-14 Jan 1972.

A test bed electric vehicle was developed to provide a most favorable operating environment for state-of-the-art lead-acid storage batteries. Performance data were acquired using portions of SAE J227, Electric Vehicle Test Procedure. Test results illustrate the performance potentials for special purpose road vehicles designed around this power source.

Search terms: Lead acid batteries; Performance characteristics; Electric vehicles; Performance tests; Test facilities; Test equipment

AVAILABILITY: SAE

HS-011 331 Fld. 5/15; 5/20

DAIHATSU S-37 MINI CABOVER ELECTRIC TRUCK AND ITS ELECTRIC EQUIPMENT

by Isamu Takaoka; Ichiiro Umotor; Shiro Kawakatsu

Daihatsu Kogyo Co. Ltd. (Japan)

1972 8p
Report no. SAE-720189

Presented at Automotive Engineering Congress, Detroit, 10-14 Jan 1972.

A recently introduced Japanese electric light truck, the Daihatsu S-37, is described. Its dimensions are: length 9.84, width 4.25, and height 4.25 ft. The truck's maximum speed is 40 mph. The driving range per charge with a payload of 450 lb and two persons is 40-50 miles. The vehicle contains a series-wound traction motor of 10 hp peak power rating an SCR chopper speed control unit, and six 12 V batteries of 150 AH capacity. In Japan many Daihatsu S-37 vehicles are in commercial use as delivery trucks for milk and other good and have acquired a good reputation.

Search terms: Japanese vehicles; Electric trucks; Truck performance; Truck specifications; Truck design

AVAILABILITY: SAE

HS-011 332 Fld. 5/15

PRACTICAL OPERATION OF ELECTRIC VEHICLES IN INDUSTRY

by Berkeley S. Hender

1972 6p 3refs
Report no. SAE-720190

Presented at Automotive Engineering Congress, Detroit, 10-14 Jan 1972.

The battery electric vehicle has had limited success except in the United Kingdom, where large fleets operate mainly for the dairy industry. Changing social conditions are now bringing modifications to these fleets where many vehicles are used as traveling shops dealing in a wide variety of domestic goods. The development is seen as the forerunner of wider use of general-purpose

5/15 Propulsion Systems (Cont'd.)

HS-011 332 (Cont'd.)

vehicles, requiring improved performance and range. The operating costs and high reliability of the vehicles have been proved. Some typical costs are given, together with those for backup mechanical handling industrial trucks. Improvements in energy sources and other components are now becoming apparent. These, together with growing world-wide interest, predict a vast growth in the industry, particularly in commercial applications for battery electric trucks and vehicles.

Search terms: Electric vehicles; Electric trucks; Vehicle operating costs; Industrial trucks; Mileage range; Sociological factors; Great Britain

AVAILABILITY: SAE

HS-011 333 Fld. 5/15

A FUEL-CELL/LEAD-ACID-BATTERY HYBRID CAR

by M. R. Andrew; W. J. Gressler; J. K. Johnson; R. T. Short; K. R. Williams

Shell Res. Ltd.

1972 8p 10refs
Report no. SAE-720191

Presented at Automotive Engineering Congress, Detroit, 10-14 Jan 1972.

A DAF 44 saloon car has been extensively modified to study some of the problems associated with building, controlling, and driving a car powered by a fuel-cell battery. A prototype hybrid car has been made, using as a power source two 12-cell hydrazine/air fuel batteries in conjunction with six conventional 6-cell lead-acid accumulators. The car has been successfully demonstrated on several occasions, and its performance has been measured. The performance of the car, in its present form, falls between that of today's internal-combustion-engined vehicles and that of secondary-battery-powered ones. However, unlike more conventional electric cars, its ranges under town driving conditions and at its steady cruising speed are not limited by the quantity of stored electricity. Some general comments are made on possible future developments.

Search terms: Automobile modification; Fuel cells; Hydrazine air fuel cells; Hybrid automobiles; Mileage range; Lead acid batteries; Automobile performance; Electric automobiles

AVAILABILITY: SAE

HS-011 334 Fld. 5/15

AUXILIARY SERVICES FOR A FUEL-CELL HYBRID ELECTRIC CAR

by M. R. Andrew; W. J. Gressler; J. K. Johnson; R. T. Short; K. R. Williams

Shell Res. Ltd.

1972 15p 4refs
Report no. SAE-720192

Presented at Automotive Engineering Congress, Detroit, 10-14 Jan 1972.

This paper describes the development of the pumps, blowers, and electronic control systems for a fuel-cell/lead-acid-battery hybrid electric car. Wherever possible, commercially available equipment was used in order to reduce costs and expedite the completion of the vehicle. With the chosen components and their associated control circuits, a vehicle was completed which behaves much like conventional cars with two-pedal controls. It is concluded that if low-cost fuel cells were to become available, the construction of auxiliaries to provide a satisfactory vehicle would not prove difficult.

Search terms: Lead acid batteries; Hybrid automobiles; Electric automobiles; Fuel cells; Pumps; Electronic devices in vehicles; Blowers; Electric automobile fittings

AVAILABILITY: SAE

HS-011 335 Fld. 5/15; 5/6

EVALUATION OF POWER-TRAINS FOR HYBRID HEAT ENGINE/ELECTRIC VEHICLES

by H. T. Sampson; H. J. Killian

Aerospace Corp.

1972 14p 9refs
Report no. SAE-720194

Presented at Automotive Engineering Congress, Detroit, 10-14 Jan 1972.

Hybrid powertrain configurations were evaluated for several classes of vehicles. This paper presents a discussion of the type of hybrid powertrain configurations evaluated, their respective modes of operation, a discussion of computer simulation of powertrain/vehicle performance, and the effect of the performance of several key powertrain components such as heat engine, battery, and electric drive motor on vehicle emissions. Based on power and torque requirements for various classes of vehicles as derived from basic specifications and performance guidelines, it was found that the necessary hybrid powertrain configurations would be composed of major components of a relatively feasible efficiency and size. It was also found that vehicle emissions are relatively sensitive to electric drive motor efficiency and relatively insensitive to battery recharge efficiency. Driving-cycle characteristics were shown to have a significant effect on theoretical average emission levels. Overall, the results suggest that the hybrid/electric powertrain appears to offer promise as a means of obtaining low-emission vehicles compatible with the 1975-1976 Federal Emission Standards.

Search terms: Hybrid vehicles; Hybrid engines; Hybrid automobiles; Engine operating conditions; Torque; Power trains; Computerized simulation; Electric drive systems; Engine performance; Engine size; Battery charging; Hybrid buses; Hybrid trucks; Exhaust emissions measurement; Computer programs

AVAILABILITY: SAE

5/17 Safety Defect Control

HS-011 336 Fld. 5/17

AUTOMOBILE DEFECT RECALL CAMPAIGNS—A SURVEY OF TIME PHASED EFFECTIVENESS AND OWNER SATISFACTION

by Harold L. Henderson; John J. Dunstone; Norman A. Carter; Paul I. Hettich

INTEXT; Scranton Univ.; Lackawanna County AVTS; Barat Coll.

Published in HS-011 284, *American Association for Automotive Medicine Proceedings of Fifteenth Conference*, New York, 1972 p233-44

Contract FH-11-6939

> Presented at the fifteenth conference of the American Assoc. for Automotive Medicine, Colorado Springs, 20-23 Oct 1971.

An investigation was made to determine the effectiveness, on a time phased basis, of defect recall campaigns in speedily removing potentially defective vehicles from the nation's roads so that actual defects could be corrected by the appropriate dealer/repair shop. A mail survey of 3,410 respondents was studied in eight defect recall campaigns. Several points were observed: large differences in time phased effectiveness exist between foreign and domestic recall efforts; more foreign car owners than domestic car owners did not receive defect notification letters, did not respond to the letters, or experienced longer delays in having their vehicles corrected; and foreign and domestic campaigns differed on the dimensions of defect hazard category, campaign size, and campaign recency. From this study, it appears that the effectiveness of defect recall campaigns is not very great.

> Search terms: Defect correction; Recall campaigns; Foreign automobiles; Safety program effectiveness; Surveys; Questionnaires

HS-011 337 Fld. 5/17

ACOUSTICAL HOLOGRAPHY

by Victor I. Neeley

Holosonics, Inc.

1972 9p 5refs
Report no. SAE-720173

> Presented at Automotive Engineering Congress, Detroit, 10-14 Jan 1972.

Acoustical holography is a real-time nondestructive testing technique which produces a visual image of the internal structure of the part being examined. This technique uses ultrasound to visually detect the presence of any anomalous condition in the material under test. Since the visual image presented shows the position and orientation of all flaws, the integrity of the material is immediately determined. The detection of cracks, voids, nonbonds, and other anomalous conditions interior to metals, ceramics, and plastics can be carried out on a high-volume, production-line basis. Various applications to the automotive industry are discussed.

> Search terms: Nondestructive tests; Quality control; Manufacturing inspection; Holograhpic interferometry; Acoustic measurement; Structural analysis; Ultrasonics; Defect correction

AVAILABILITY: SAE

HS-011 338 Fld. 5/17

NUCLEAR TECHNIQUES FOR PRODUCT INSPECTION AND QUALITY ASSURANCE

by Robert F. Hill

General Motors Corp.

1972 7p 7refs
Report no. SAE-720174

> Presented at Automotive Engineering Congress, Detroit, 10-14 Jan 1972.

This increasing emphasis on automotive safety and reliability through product assurance has further stimulated the development of new and improved inspection methods. Nuclear techniques are finding ever-increasing application in this area, and have been used successfully in a variety of automotive inspection problems. Some of the unique methods which have been developed are presented to demonstrate the versatility of nuclear techniques when unusual inspection problems arise. Applications described include: measurement of oil consumption of production engines, monitoring composition of continuously cast bearing material, detection of internal voids in plastic-foam parts, and measurement of the moisture content of foundry sand.

> Search terms: Manufacturing inspection; Quality control; Oil consumption; Bearing materials; Moisture content; Sand; Neutron activation analysis; X ray analysis; Plastic foams; Radioisotopes; Fluorescence; Nondestructive tests; Inspection equipment

AVAILABILITY: SAE

5/18 Steering Control System

HS-011 339 Fld. 5/18; 4/5; 4/7

DYNAMICS OF WHEELED VEHICLES. A STATISTICAL ANALYSIS OF TERRAIN-VEHICLE-SPEED SYSTEMS. REPORT 3

by N. R. Murphy, Jr.

Army Engineer Waterways Experiment Station

5/18 Steering Control Systems (Cont'd.)

HS-011 339 (Cont'd.)

1971 119p 9refs
Report no. TR-M-68-1

The specific objective of this study was to define and formulate the procedures for implementing a practical, compact description of terrain-vehicle-speed systems and thus establish a methodology for relating measures of ride to measures of terrain roughness and cross country speed. This methodology should enable the determination of reliable estimates of the average speed a given vehicle can attain under given vibrational constraints as well as the probabilities of exceeding certain specified levels. Digital computer simulations were conducted in which a vehicle was run at several selected speeds over terrain profiles with various levels of roughness. A mathematical model of an M37 truck served as the vehicle. This model allowed for nonlinearities inherent in large rotational motions, the suspension elements, bump stops, loss of ground contact, and tire compliance. Results are presented in graphs.

Search terms: Mathematical models; Computerized simulation; Vibration; Vehicle riding qualities; Speed patterns; Digital computers; Topographical factors; Vehicle soil interface; Truck tests; Tire soil interface; Ground roughness; Off the road vehicles; Computer programs; Vehicle dynamics; Statistical analysis

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NHTSA DOCUMENTS

NHTSA Contractors Reports

HS-800 658 Fld. 1/3

MULTIDISCIPLINARY ACCIDENT INVESTIGATION REPORTS

by Parker A. Glass, ed.

Boston Univ.

1972 208p
Contract FH-11-7402
Report no. FR-3

On-scene and subsequent investigations of 39 accidents (37 with resulting fatalities) from 1 July 1969-31 August 1970 involving 63 vehicles and a total of 100 occupants are presented. A description of methodology is given. Trends are discussed, standards are evaluated and conclusions and recommendations are given. A summary and collision diagram for each of the 39 cases are included.

Search terms: Accident investigation; Accident case reports; Fatality causes; Occupant kinematics; Autopsies; Vehicle safety standards; Accident causes; Blood alcohol levels; Restraint system usage; Alcohol usage; Accident scale drawings; Multidisciplinary teams; Fractures; Ruptures; Accident location; Precrash phase; Crash phase; Postcrash phase; Vehicle dynamics; Weather; Highway characteristics; Safety device effectiveness; Environmental factors; Driver characteristics

AVAILABILITY: NTIS

HS-800 663 Fld. 1/5

STATISTICAL ANALYSIS OF 102-INCH WIDE INTERCITY BUS ACCIDENT DATA. FINAL REPORT

by Fred M. Heider

Control Systems Research, Inc.

1972 159p
Contract HS-018-1-101

The accident record of 102-inch-wide intercity buses employed by interstate carriers is compared to the accident record of standard 96-inch buses operated in comparable environments. A major product is the establishment and comparison of mean accident rates on a bus mile basis for each type of bus. In addition, each of the accidents involving 102-inch buses is examined for evidence of causes that are of high interest such as aerodynamic effect, increased width, and lateral stability. Accident reports are analyzed for differences in severity, configuration, distribution of injuries, and other characteristics by type of bus.

Search terms: Accident records; Accident rates; Vehicle mileage; Bus accidents; Bus stability; Accident studies; Accident statistics; Statistical analysis; Accident causes; Vehicle width; Accident severity; Accident factors; Accident causes; Injury severity; Wind forces; Aerodynamics; Environmental factors

AVAILABILITY: NTIS

HS-800 665 Fld. 5/22

A TRUCK AND BUS TIRE USE PATTERN STUDY. FINAL REPORT

by I. R. Ehrlich; I. O. Kamm; M. P. Jurkat; T. H. Jackson

Stevens Inst. of Tech.

1971 131p 16refs
Contract FH-11-6090; NBS-142-70
Report no. SIT-DL-71-1573; R-1573

A survey was performed to determine pressure, loading, tread depth, and tire condition of 5,300 truck tires on the road and 400 truck and bus tires in truck terminals. The most significant results of the road survey are: 4.3% of all tires were found under-pressured and 11% overloaded; 3.4% had major damage; 5% were below minimum tread depth.

Search terms: Bus tires; Truck tires; Tire wear; Tire characteristics; Tire tread depths; Tire inflation pressure; Tire loads; Tire defects; Defective tires; Tire maintenance; Fleet safety; Tire safety; Data acquisition; Tire temperature; Tire standards

AVAILABILITY: NTIS

NHTSA Staff Speeches, Papers, etc.

HS-810 199 Fld. 3/1

REMARKS AT KICK-OFF CEREMONIES OF THE NEW HAMPSHIRE ALCOHOL SAFETY ACTION PROJECT, CONCORD, APRIL 14, 1972

by Charles F. Livingston

National Hwy. Traf. Safety Administration

1972 10p

The relationship between drinking and accidents is discussed. Public education programs about drunk driving are described. Other efforts to control the problem include research and development programs, Alcohol Safety Action Projects, and state programs in alcohol countermeasures.

> Search terms: Alcohol usage deterrents; Alcohol Safety Action Projects; Drinking drivers; Driver intoxication; Problem drivers; State action; Alcohol education; Accident causes; Accident repeater drivers

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HS-810 201 Fld. 4/2

THE USER'S ROLE IN HIGHWAY SAFETY SUPPORT

by Charles H. Hartman

National Hwy. Traf. Safety Administration

1972 6p

> Presented at 14th Highway Transportation Congress, Washington, 1 Jun 1972.

The needs of highway safety in a free society cannot be met without public support, and an informed public is needed. The role of support groups in the private sector in furthering highway safety programs is described. This role should focus on general public information efforts followed by appeals for the support of specific programs after the basic groundwork has been laid. The ways in which public information efforts should be conducted are discussed.

> Search terms: Highway safety organizations; Community support; Safety propaganda; Highway safety programs; Safety campaigns; Public information programs; Public opinion

AVAILABILITY: NHTSA

HS-810 203 Fld. 4/2

THE NATIONAL HIGHWAY SAFETY PROGRAM AND IMPLEMENTATION AT THE STATE LEVEL

by Glenn V. Carmichael

National Hwy. Traf. Safety Administration

1972 9p

> Presented to Southern Conference of the Council of State Governments, Committee on Transportation, Washington, 25 May 1972.

Accomplishments to date in the national highway safety program are described, and state programs are discussed. Support of the highway safety program standards and state implementation are needed to prepare for the future. By the year 2000 the density of present metropolitan areas will have doubled, and there will be a great many more drivers. Action is needed now to deal with the problems posed by a population of 280 million in the year 2000.

> Search terms: State planning; Highway safety programs; Highway safety standards; State action; Population density

AVAILABILITY: NHTSA

HS-810 212 Fld. 2/0

STATEMENT FOR THE RECORD BEFORE THE SUBCOMMITTEE ON ROADS, COMMITTEE ON PUBLIC WORKS, U. S. SENATE, JUNE 15, 1972

by Douglas W. Toms

National Hwy. Traf. Safety Administration

1972 78p

The highway safety problem, state and community highway safety programs, and program accomplishments and plans are described. Specific aspects discussed are: driver control through licensing, rehabilitation, and police traffic services; alcohol countermeasures; driver education; pedestrian safety; emergency medical services; motor vehicle inspection; safety manpower development; unifying the highway safety standards; and legislative needs.

> Search terms: Highway safety programs; State action; Community support; Driver licensing; Driver rehabilitation; Police traffic services; Alcohol usage deterrents; Driver education; Pedestrian safety; Emergency medical services; Vehicle inspection; Manpower utilization; Highway safety standards; Safety laws

AVAILABILITY: NHTSA

HS-810 213 Fld. 4/4

HIGHWAY SAFETY MANPOWER DEVELOPMENT: NARROW THE SIGHTS AND BROADEN THE VISION

by Charles H. Hartman

National Hwy. Safety Bureau

1970 11p

> Presented at Mid-Western Seminar sponsored by Highway Users Federation, Milwaukee, 8 Nov 1970.

NHTSA Staff Speeches, Papers, etc. (Cont'd.)

HS-810 213 (Cont'd.)

The need for determining priorities in the highway safety manpower development field is described, and it is suggested that different organizations should have different priorities. The steps in determining manpower priorities are: identification of task requirements, numbers and types of manpower required; recommendation of national manpower policies and priorities; development of plans for meeting nation's manpower needs; identification of numbers and types of training resources available; development of training resources and materials; conducting or sponsoring training programs; evaluation of program effectiveness.

Search terms: Highway safety organizations; Highway safety programs; Manpower utilization; Priorities; Program evaluation

AVAILABILITY: NHTSA

NHTSA Imprints

HS-820 190 Fld. 5/6

MOTOR VEHICLE EMISSIONS: A SELECTED BIBLIOGRAPHY

National Hwy. Traf. Safety Administration

1972 39p

Literature citations on many aspects of vehicle emissions in relation to air pollution are listed. Citations are grouped separately as congressional documents, monographs, journal articles, reports, and chapters within books and proceedings. Citations pertaining to nonconventional fuels and electric vehicles are included.

Search terms: Bibliographies; Vehicle air pollution; Air pollution emission factors; Air pollution effect on health; Exhaust emissions; Electric vehicles; Fuels

AVAILABILITY: NHTSA

SPECIAL ANNOUNCEMENT

We will be pleased to announce in HSL your research paper or research report not previously announced in this journal. The material must be directly related to Highway and/or Motor Vehicle Safety and must fall within the scope of the Table of Contents – Subject Fields and Groups.

Send your material, one (1) copy, along with your approval to announce, to:

Mr. Frank Skubel
Information Systems Division (43-33)
National Highway Traffic Safety Administration
400 7th Street, SW., Room 5125
Washington, D.C. 20590

Please indicate the availability source and price if there is a charge for the item.

HS-820 193 Fld. 2/9

CRITERIA FOR THE DESIGN AND DEPLOYMENT OF ADVANCED GRAPHIC GUIDE SIGNS

by John W. Eberhard; Wallace G. Berger

National Hwy. Traf. Safety Administration; Michigan Univ. Hwy. Safety Res. Inst.

1971 19p 5refs
Contract FH-11-7284

Describes study with above title performed by Serendipity, Inc. under contract for NHTSA in Sept. 1970, indexed as HS-800 373.

This study was designed to determine what graphic sign characteristics best communicated roadway interchange and route guidance information to drivers. Emphasis was placed upon developing laboratory sign testing procedures for determining effectiveness of signing alternatives and analytical techniques for identifying interchange characteristics where graphic guide signs might be required and applicable.

Search terms: Direction signs; Sign tests; Sign design; Laboratory tests; Sign location; Graphic techniques; Sign effectiveness; Lane changing; Highway characteristics; Interchanges

AVAILABILITY: NHTSA

executive
summary

YNOPSIS OF A RECENTLY RELEASED NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION RESEARCH REPOR

DAISY TRACK HUMAN TOLERANCE TESTS FINAL REPORT

This project involved impact tests with human subjects for the purpose of comparing the subjective tolerance levels during impack of the following restraint systems: (l) lap belt; (2) lap belt plus air bag.

PO-1-6618	Award Amount: $342,000.00
Aeromedical Research Laboratory	Contractual Period:
Holloman Airforce Base	June 28, 1967 through June 30, 1969

DOT/HS-800 419 Final Report

STUDY APPROACH

The experimental approach as specified in the work statement called for subjecting five human subjects to increasingly severe impacts in each of the two restraint configurations being compared until in the subject's opinion (subjective tolerance) or the medical monitor's opinion the testing of either of the two restraint configurations in question should be terminated. Testing with the other restraint was to be continued until a similar level was reached. Tolerance levels would then be compared.

Male human volunteers were subjected to impact while seated on the Daisy Decelerator impact sled using each of the restraint systems being tested. The seat used on the sled during all of these tests was one which was designed for other Aerospace Research Laboratory human impact tests. It contained instrumentation capable of measuring all forces transmitted to it by the subject during impact. The seat pan was horizontal and the seat back was angled backwards 13° ffrom vertical.

TESTS

The report describes the tests conducted during the course of this study.

A definite subjective tolerance level for the lap belt restraint was not reached because the medical monitor concluded, on the basis of increasing lap belt loads and post-run pain symptoms, that to continue to a higher "g" level would constitute an undue injury hazard for the subjects despite their willingness to continue to a higher level. A definite subjective tolerance level for the lap belt plus air bag was also not achieved because tests were stopped when it appeared likely that even if the air bag series were continued to higher "g" levels, this series might also be stopped by the medical monitor for safety reasons before an actual subjective tolerance was reached.

CONCLUSIONS

In the opinion of the contractor a number of conclusions may be made from this test series:

- The subjective impact tolerance limit using lap belt only restraints is somewhere in excess of 15 g's for the groug of subjects consisting of young Air Force personnel when using a half-sine deceleration pulse and two foot stopping distance.
- The subjective impact tolerance limit of the subjects would appear to be somewhat higher using a lap belt puls rapidly inflating air bag than with the lap belt alone. The contractor bases this conclusion on the fact that the incidence and severity of both neck and hip pain symptoms were significantly less using the air bag at 12 g's than with the lap belt only at this level. It should be noted also that the amount that subjects brace before impact significantly affects both peak loads and rebound back into the seat. The amount of bracing should be considered when comparing individual runs.
- The primary benefit of the air bag system in reducing impact injuries is its ability to limit forward motion of the head and upper torso to prevent secondary impact with the instrument panel and windshield. This benefit is not reflected in the subjective tolerance limits.

The Contract Technical Manager has certified that the contractor's work has been satisfactorily completed and that all contractual obligations have been met.

The opinions, findings, and conclusions expressed in this summary are those of the contractor and not necessarily those of the National Highway Traffic Safety Administration.

Availability: National Technical Information Service (NTIS), Springfield, Va. 22152. Order in paper copy (PC) or microfiche (MF), DOT/HS-800 419

executive summary

A SYNOPSIS OF A RECENTLY RELEASED NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION RESEARCH REP

DAISY TRACK BABOON LETHAL TOLERANCE TESTS. FINAL REPORT

The purpose of this project was to conduct a series of comparative investigations to assess the biodynamic aspects and the protection from impact trauma provided by the lap belt, lap belt plus air bag and air bag only restraint systems. The objectives were to determine a lethal tolerance (LD_{50}) by exposure to abrupt linear deceleration ($-G_X$) and to define the patterns of injuries.

PO-1-6618
Aeromedical Research Laboratory
Holloman Airforce Base

Award Amount:
$342,000.00
Contractual Period:
June 28, 1967 through
June 30, 1969

DOT/HS-800 420 Final Report

STUDY APPROACH

1. Lab Belt Series

Twenty-nine deceleration tests were performed with 19 adult male baboons (Papio anubis) weighing in excess of 45 lbs (mean of 51 lbs). Tolerance to impact (LD_{50}) was determined by sequential testing: each baboon was impacted at a 3g increment below or above the deceleration of the previous test, respectively depending upon whether there was or was not a fatality within three hours on the previous test. The primary advantage of this method was the concentration of testing near the tolerance level thus increasing the accuracy of LD_{50} estimation. The LD_{50} was that level where impact fatalities were expected in 50% of the animals.

Entrance velocities ranged from 24.8 to 53.8 ft/sec, onset from 103 to 984 g/sec and peak sled deceleration from 8.6 to 40g. The impact pulse was approximately half sine with stopping distance maintained constant at two feet resulting in total pulse durations of 0.080 to 0.213 sec.

Prior to each impact test the animal was premedicated with 1 mg/kg body weight of Sernylan and 0.4 mg atropine. After positioning the animal on the sled, sodium pentobarbital was administered to obtain surgical anesthesia. The baboon torso was maintained in a proper sitting position by a strap around the thorax and seat back. This strap did not contribute as a restraint during impact since it was mechanically released less than 0.1 sec before the deceleration pulse.

Whole body radiographic coverage and a physical examination were performed immediately post-impact in order to delineate fractures and gross trauma. Gross necropsy was conducted within one hour post-impact for the terminated subjects or 24 hours later for the surviving animals. Animals receiving less than 20g were not euthanized because of the absence of traumatic injuries.

The baboon seat and restraint system was reduced proportionately from human seat and belt dimensions. The seat pan was horizontal and the back was 13° from vertical. A one-inch thick cushion (foam rubber covered with plastic) was affixed to the seat pan. The floor of the sled was padded with three inches of Ensolite.

The rigid seat pan was instrumented with strain gauges to provide independent outputs of forces translated fore - aft, lateral and down independent of the point of application. The rigid seat back was similarly instrumented for force determination in the up - down, lateral and aft directions.

The lap belt angle was 50° to the plane of the seat pan. One-inch dacron webbing of 3700 lbs tensile test was fitted around the abdomen in an arc of 165° and statically tensioned for each side at approximately ten pounds. Each lap belt attach point was instrumented with a tri-axial load cell which measured forces in three axes and enabled calculation of resultant force magnitudes and directions.

Photographic coverage included use of three 16 mm cameras operated at 2000 frames/sec and a 35 mm camera operated at 500 frames/sec.

One 16 mm camera was mounted 13 ft vertical to the impact area; the remaining cameras were located 40 ft normal to the deceleration area in the same horizontal plane.

2. Air Bag Series

Thirty deceleration tests were performed with 20 adult male baboons weighing from 43 to 54 lbs. Eight of the tests were conducted with the air bag only restraint; the remaining tests were designed to evaluate the air bag used in conjunction with a lap belt.

Entrance velocities ranged from 25.0 to 88.2 ft/sec, onset from 109 to 5482 g/sec and peak sled deceleration from 8.6 to 123g. The impact pulse was approximately half sine with stopping distance maintained constant at two feet resulting in total pulse durations of 0.045 to 0.213 sec.

The animal preparation, instrumentation and photography were basically similar to the lap belt series. However, a brief explanation of the experimental seat layout may be useful.

The seat-windshield configuration and the air bag restraint were scaled down to accomodate the size of the baboon. The bag volume approximated seven cubic feet at full inflation. Prior to the deceleration test the nylon bag was folded and mounted within the simulated dash. The folded bag was positioned at the diaphragmatic level of the baboon and approximately 17 inches anterior to the seated subject. The windshield and dash were located within the rotational envelope of the baboon head. Without the air bag the
animal would have invaribly impacted the windshie
dash or floor of the sled.

A series of electrical contact strips were affixed to
windshield and dash to detect subject contact. W
one possible exception there was no indication t
the baboon contacted the windshield during
impact event. Additionally, examination of
high-speed films revealed that the head usually clea
the windshield structure by several inches.

The bag inflation was mechanically triggered at
initiation of the sled deceleration pulse. The inflat
was effected by the detonation of an explosive va
which permitted rapid expansion of gas into the
from a 3400-3600 psi nitrogen reservoir. The initiat
of air bag deployment was recorded on oscillogra
and was indicated on the high-speed films by a str
flash.

As the air bag filled, pressure relief ports located
either side of the bag ruptured. This permitted a c
trolled exhaust of the gas so that the restraint did
act as an "air spring."

The preload pressure within the bag was provided
gas from the nitrogen reservoir. The restraining fo
of the air bag was dependent upon the gas press
within the bag. In turn, the pressure within the
during loading was a function of the subject's surf
area in contact with the bag, velocity relative to
bag and area of the pressure relief ports.

The least calculable design parameter for the air
was the size of the pressure relief ports. Therefore
was essential to conduct a series of deceleration te
to choose one air bag port size which could be to
able for a deceleration range extending from 9
120g. Four tests to determine this port size were c
ducted near 55g with a sled entrance velocity of
ft/sec. The data were proportionately adjusted
reflect a standard animal weight of 50 lbs and a s
deceleration of exactly 55g.

MAJOR FINDINGS AND CONCLUSIONS

Test Results

The results indicated that the lowest lap belt for
were recorded with the 3-1/2" port. Yet, the sm
port resulted in relatively large rebound forces.
decision was made to use the 5" port for the test se
based upon the presumption that the subject co
tolerate increased force transmitted to the pelvis w
less consequences than whiplash injury resulting fr
rebound into the seat back.

The tolerance to impact was expressed as the percentage of subjects not surviving the effect of sled deceleration. Employing probit analysis, the median lethal sled deceleration (LD_{50}) for the lap belt only series was calculated to be 32±4g. The validity of the regression line was confirmed by a Chi-square test.

Eight baboons restrained with an air bag plus lap belt and another eight restrained with an air bag only were impacted with peak sled decelerations ranging from 115 to 123g. Fatalities, defined for this series as death occurring within three hours post-impact did not occur with either air bag restraint system. In comparison with the lethal tolerance (LD_{50}) of 32g established with the lap belt series, the test results of the air bag restraint demonstrated at least fourfold increase in survivable deceleration. However, the ultimate effectiveness or a specific lethal tolerance impact (LD_{50}) using either of the two air bag systems could not be established in terms of sled deceleration since sled decelerations in excess of 125g could not be conducted because of structural and safety limitations of the sled system.

For the lap belt series distribution of baboon injuries closely coincided with the reported trauma resulting from motor vehicle accidents. Although details of the pathology and presumed etiology will appear subsequently in later reports, the predominant injuries included abrasions and contusions of the anterior abdominal wall, ruptured urinary bladders, pelvic fractures, brain stem hemorrhage, cranial fractures, avulsion of the atlanto-ocipital articulation and dislocation fractures of the cervical vertebrae with resulting transection of the spinal cord. The severity of injuries indicated that fatality was not directly attributable to the lap belt, i.e., pelvic injuries did not produce death. Rather, it was presumed that lethal head-neck trauma was produced by the secondary impact with the padded floor of the sled.

Of the eight animals restrained with an air bag plus lap belt, the three fatalities that occurred were at 3.5, 10.5 and 11 hours post-impact. The predominant injuries in the air bag-lap belt group included abrasions and contusions of the anterior abdominal wall, rupture of the rectus abdominus and quadriceps femoris muscles, serosal hemorrhage of the urinary bladder diaphragmatic tearing occasionally accompanied with intestinal herniation. It was presumed that hemorrhage and pneumothorax contributed significantly to the three deaths.

The types of injuries with the air bag plus lap belt indicated that trauma was directly attributable to the lap belt or to the violent rotation of the baboon around the lap belt. Although not entirely similar to the pelvic injuries sustained 32g restrained with just a lap belt, the pelvic injuries resulting from the air bag plus lap belt at 120g did not appear to be appreciably more severe.

There were no fatalities nor any significant degree of incapacitation in the eight animals restrained with just the air bag. These animals typically displayed moderate erythema over the thorax and extremities plus hemorrhage in the soft tissues around the femoral-tibial joint. The knee injuries were attributable to contact with the supporting structures for the windshield.

There was no indication of head-neck trauma in either group of animals. This was contrary to the predominant occurrence of lethal head-neck trauma observed in the lap belt only series.

Conclusions

For the lap belt series, results indicate that peak sled decelerations can be correlated with tolerance to impact. The median lethan sled deceleration (LD_{50}) was calculated to be 32±4g for animals restrained with just a lap belt. Likewise, the study revealed the lifesaving potential of the air bag restraint. Sixteen baboons survived peak sled decelerations in the vicinity of 120g. This was an approximate fourfold increase in survivable deceleration compared with the impact fatalities incurred while restrained with only a lap belt. The increased frequency of survivability with the air bag system resulted from the elmination of lethal head contact with the windshield, dash or floor of the sled.

The favorable impact protection afforded by the air bag without the lap belt in the $-G_X$ direction was clearly demonstrated. However, until air bags giving passenger protection during side-impacts and roll-overs have been fully documented, the elimination of restraint belts in automobiles cannot be advocated.

The Contract Technical Manager has certified that the contractor's work has been satisfactorily completed and that all contractual obligations have been met.

The opinions, findings, and conclusions expressed in this summary are those of the contractor and not necessarily those of the National Highway Traffic Safety Administration.

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